ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Road Salt and Water Quality

Background

The amount of snowfall in northern New England and the necessity of overland travel require the use of plows and de-icing materials to keep highways safe in the winter. Salt, or sodium chloride, is the most commonly used de-icing material in New Hampshire. In general, the purpose of salt is to: 1) reduce adherence of snow to the pavement; 2) keep the snow in a "mealy" condition and thereby permit nearly full removal by plowing; and 3) prevent the formation of ice or snow ice (hard pack).

Sodium chloride can negatively impact drinking water and aquatic life. Sodium is a drinking water concern for individuals restricted to low-sodium diets due to hypertension (high blood pressure), although a review of scientific evidence by the U.S. Environmental Protection Agency showed that the vast amount of sodium ingestion (90 percent) was from food rather than drinking water and that the linkage between sodium and hypertension was still not well documented. Chloride can affect the taste of drinking water, but is not a health concern. If levels of either sodium or chloride approach 250mg/l in drinking water, an alternative source should be found. Chloride ions were found by the U.S. Environmental Protection Agency to be toxic to certain forms of aquatic life at a four-day average concentration of 230 mg/l. Some plant species at the base of the food chain can be impacted at much lower concentrations.

Roadside vegetation is visibly impacted from road salt. Burned grass and shrubs, as well as burned foliage on roadside trees from salt spray are common in New Hampshire.

Road Salt Management Issues

The New Hampshire Department of Transportation's (DOT) winter maintenance goal is to obtain bare and dry pavements on most roads at the earliest practical time following cessation of a storm. Many municipal highway departments have similar goals. Traffic volume, speed, and gradient are the primary factors in determining the level of winter maintenance service for particular roads. When the temperature is 20^{o} F or greater, DOT applies 250-300 lbs. of salt per lane-mile and/or abrasive (sand) as needed. At temperatures below 20º F, DOT uses various combinations of salt, sand, and calcium chloride, depending on road conditions.

Salt storage facilities can have a greater potential for causing water pollution than roadway application. For maximum environmental protection, salt storage facilities should be roofed and paved, with adequate drainage controls to prevent runoff water from contacting salt.

Alternatives to Road Salt

Salt is the most commonly used highway de-icer. Its effectiveness decreases as temperatures drop. Salt is most effective at temperatures above 20º F. Below 10º F, salt cannot dissolve and cannot break the ice-pavement bond.

The second most commonly used de-icing chemical, calcium chloride, is effective in much lower temperatures than salt (as low as 0º F). Liquid calcium chloride can be used to pre-wet salt and sand, which can facilitate de-icing at lower temperatures. The disadvantages to calcium chloride are: 1) it costs more than salt; 2) it is difficult to handle and store; 3) if used alone it may contribute to slippery, black-ice conditions; and 4) the presence of chloride ions makes calcium chloride at least as corrosive to structural materials and toxic to aquatic life as salt.

Sand is sometimes considered an alternative to salt. Sand does provide additional traction in slippery conditions but it cannot melt snow and ice on the road surface. A disadvantage to sand is that great effort must be expended to clean the sand from road surfaces at the end of winter to prevent clogging of roadside ditches and catch basins, and eventually sedimentation in water bodies.

Calcium magnesium acetate (CMA) is another alternative to salt. CMA is made from limestone and acetic acid, the principal ingredient of vinegar. CMA is less damaging to soils, less corrosive to concrete and steel, and non-toxic to aquatic organisms. It is also benign to roadside vegetation. The components of CMA are not harmful to groundwater, although CMA, like salt, has the potential to mobilize trace metals (Fe, Al, Zn, Cu) through cationic exchange reactions in soil. A drawback of CMA is its cost, about $600/ton, compared to about $40/ton for salt. However, a full cost analysis, comparing CMA to salt is needed to determine the full cost of both alternatives. CMA use should lead to longer lasting bridges and cars and less environmental damage. Including avoided costs, CMA may be an economically viable alternative to salt, even though its initial cost is 15 times greater.

DOT Reduced Salt Pilot Program

Chapter 239, Laws of 1994, authorized and required the DOT, in cooperation with the Nashua Regional Planning Commission, to implement a pilot program to minimize salt use during the winters of 1994-95 and 1995-96. Three test sections were found on low traffic volume highways in the Nashua region, public hearings were held, and warning signs were posted on the roads. During the two winters, test sections were treated with approximately one half the amount of salt used on the control sections, which were treated using standard DOT procedures. DOT evaluated road conditions, accidents, costs, environmental benefits, and public acceptance of the pilot program. Monitoring wells were installed along test and control highway sections to measure chloride levels in groundwater.

The results of the pilot program were:

1. While poorer driving conditions were noted on the test sections, safety was not significantly compromised by the reduction in salt use. This was attributed to the absence of curves, hills, and heavy traffic on test sections, as well as the highway signing and public notification of the program.
2. While substantial savings for salt were noted, other costs such as sand and labor were higher. Additional costs were estimated by DOT at $16,774 during the two-year test period for the 8.3 lane-miles in the test sections. It was noted that additional costs could

be incurred due to sand cleanup for lawns, drainage ditches, and culverts. DOT also noted that the higher costs were partially due to the short length of the test sections.
3. Public acceptance of the test was mixed. Very few complaints were from the public, but local police were less than satisfied with road conditions during storms.
4. In each test section chloride levels in monitoring wells were substantially lower than those in corresponding control sections. Application of additional sand in test sections created environmental concerns due to sediment deposition, but these impacts were not measured.

DOT concluded that reduced salt application for winter maintenance is beneficial within very specific parameters. The type of highway to be included in a reduced salt program needs to be carefully considered. The highway must be relatively flat, without hills and curves, and in a low speed/low volume section. Based on the results of the pilot program, DOT will consider conducting other reduced salt programs in communities which request consideration and on roads which meet the specific requirements of the program. Local officials interested in the reduced salt program should contact the DOT Bureau of Highway Maintenance at 271-2693.

Best Management Practices for Road Salt Application

Storage and Handling

- Facilities should be located on flat sites away from surface water and on impervious surfaces that are easily protected from overland runoff.
- Salt should be stored under cover to prevent a loss due to runoff.

Application of Road Salts

- Sensitive areas, such as public water supplies, lakes and ponds, should be identified and made known to salt applicators. Consider de-icing alternatives in sensitive areas.
- Ground-speed controllers should be used for all spreaders.
- Give salt time to work; time plowing operations to allow maximum melting by salt, before snow is plowed off the highway.
- Know when to plow and reapply salt. The need for another salt application can be determined by watching melting snow kicked out behind vehicle tires. If the slush is soft and fans out like water, the salt is still working. Once the slush begins to stiffen and is thrown directly to the rear of vehicle tires, it is time to plow.
- For lesser traveled roads, consider applying salt in a windrow in a four to eight foot strip along the centerline of a two lane road. Less salt is wasted with this pattern and quickly gives vehicles clear pavement under at least two wheels. Traffic will soon move some salt off the centerline and the salt brine will move toward both shoulders for added melting across the entire road width.
- Determine levels of service for all roads in a service area. Salt application rates and frequency should be based on traffic volume, road grade and curvature, intersections, and weather conditions. Sand or sand/salt mix should be used based on the level of service requirements.

Snow Dumping

Dumping plowed snow directly into waterbodies is illegal. For recommended snow dump areas, please see DES Fact Sheet **WD-WMB-3.**